



Conference Proceedings

The 6th Conference of the European Social Simulation Association

14th - 18th September, 2009

University of Surrey, Guildford, United Kingdom

Edited by

Bruce Edmonds and Nigel Gilbert

Preface

This, the 6th European Social Simulation Association Conference, like its predecessors, attracted many submissions from across the world. The papers cover a wide range of subjects: social processes of science, social conflict, market dynamics, rich cognitive models, social norms, societal transitions, human, animal and artificial, and apply a wide range of simulation techniques. The methodology and, indeed, the very nature of the enterprise will be discussed and debated during the conference.

Each of the submissions was refereed by three members of the Programme Committee and we thank them for their great contribution to maintaining the high standard of the conference. Features of this year's conference are the thematic sessions, supported by ESSA's Special interest Groups, and the session for seminars and demonstrations, which gives everyone a chance to contribute.

We welcome three distinguished guests to give invited talks. Emeritus Professor Jim Doran is one of the founders of social simulation and can be relied on to give a thought provoking and controversial presentation. Professor Tim Kohler is best known for his work on the Anasazi in New Mexico, but has done much to show the value of agent-based modelling in archaeology. Professor Mark Bedau has had a distinguished career in the Artificial Life field and is co-founder of the European Center for Living Technology (ECLT) in Venice.

This volume contains copies of all the papers presented at the conference. Some of the papers will ultimately appear in special issues of journals, but this volume represents a historic cross-section of the state of the art in social simulation in 2009. As the papers demonstrate, the field has made great advances since ESSA was founded in 2003. It will be interesting to look back in six years' time to see what has changed – my prediction is that progress will consolidate and the last few year's rapid development will mature to make social simulation an essential part of the social sciences.

The conference could not have occurred without the support of many people. First, the ESSA Management Committee should be thanked for their confidence in allowing it to go ahead despite the potential financial risk that holding it in Britain incurred. Second, we owe a great debt of gratitude to the Programme Committee and especially its Chair, Bruce Edmonds, for their work in constructing the scientific programme. Third, many thanks to those who helped with the local organisation, especially Lu Yang and members of the Centre for Research in Social Simulation, to the University of Surrey's Conference Office, and to all the helpers during the conference, distinguished by their T-shirts. And lastly, thanks to you, the participants, for all that you bring to the conference.

Enjoy not only the conference itself, but also the ambience of Guildford and the hospitality of the University.

September 2009

Nigel Gilbert
Conference Chair
ESSA'09

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Invited Talks

The Creativity of the Evolution of Technology Is a Target for Social Simulation Efforts

Mark Bedau

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Does ABSS need Cognitive Agents that are Multiple Agent Systems?

Jim Doran

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Abstract. This talk falls into three parts. In the first I shall reflect briefly on the development of artificial intelligence and of agent based modelling over the last 50 years, looking at how the former has enabled the later, and seeking to learn lessons offering guidance in the future.

In the second part of the talk, I shall start by looking at the difficulty of modelling guerrilla wars, referring in particular to the Iruba model. This leads to consideration of the problems of working with complex models, to examples of how certain types of algorithmic analysis of computational models may be performed by first formulating the models as production systems, and to the notion of models as special cases of descriptions.

Finally, I shall focus on agents, asking what are agents and how can they be identified in a real world context or algorithmically within a computational context. When, if ever, does a reliable agent-based model need to deploy intelligent agents (or genuinely cognitive agents), and what particular methodological difficulties arise? Then I shall describe the recently developed MIAP (Multiple Interacting Adaptive Projections) cognitive architecture and explain its AI, psychological and neuroscience origins. The main features of the architecture will be described, notably the use of a type of high-level building block and a stress on the emergence, rather than ad hoc programming, of functionality. The current implementation status (in C) of the architecture will be reported, and illustrated by results from recent experimental trials. In conclusion, I shall discuss the potential of the MIAP architecture both in general and specifically within ABSS, including the significance of the fact that a MIAP agent may itself be viewed as a multi-agent system.

Generative Archaeology: How even really simple models can help in understanding the past

Tim Kohler

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Abstract. Archaeology, at least in the U.S. Southwest for the period representing the spread of successful farmers in the first millennium A.D., offers us a relatively high-resolution picture of settlement patterns in the context of relatively high-resolution reconstructions of changes in climate and resources relevant to human use of these landscapes. Despite this, five archaeologists can inspect the same settlement pattern and generate five candidate processes (explanations) for its generation. Agent-based modeling helps us calibrate the connection of process to pattern. Our use of ABM in the Village Ecodynamics Project (<http://village.anth.wsu.edu/>) so far has been mainly to see what patterns we should expect if households were approximately minimizing their caloric costs for access to adequate amounts of calories, protein, water, and fuels. The differences through time in how well this expectation fits the observed record and the changing directions of departure from those expectations through time provide a completely novel source of inference on the archaeological record, and perhaps tell us something important about the human condition in general.

Plenary Presentations

Full paper

The Simplicity of Cooperation: Conditional movement rules promote cooperation

C. Athena Aktipis and John W. Pepper

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Abstract. Standard evolutionary and economic approaches to understanding cooperation assume that individual self-interest is the natural state of the world. In that view, cooperation is only viable among individuals with sufficient cognitive complexity to overcome the natural state of defection through such abilities as individual recognition, memory, punishment, commitment and other incentive and enforcement systems. The present paper challenges the view that complex cognitive abilities are necessary for the evolution of cooperation by describing the findings of two models of the evolution of cooperation: the Walk Away and environmental feedback models. In these models, individuals simply leave regions in which they receive low returns. Because the presence of defectors reduces the quality of the local environment, regions with defectors are less stable than regions of cooperators. The individual level behavior in these models generates aggregate dynamics that promote positive assortment and selection for cooperation via group selection. The basic findings of the Walk Away and environmental feedback models suggest that complex cognitive abilities may not be necessary for the evolution of cooperation and that cooperation may be the state of nature in a wider variety of contexts than previously assumed.

Full paper

A General, Evolutionary Model of Long Tailed Distributions in the Social Sciences

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Abstract. Studies of collective human behavior in the social sciences, often grounded in details of actions by individuals, have much to offer ‘social’ models from the physical sciences concerning elegant statistical regularities. Drawing on behavioral studies of social in uence, we present a parsimonious, stochastic model, which generates an entire family of real-world right skew socio-economic distributions, including exponential, winner-take-all, power law tails of varying exponents and power laws across the whole data. The widely used Albert-Barabasi model of preferential attachment is simply a special case of this much more general model. In addition, the model produces the continuous turnover observed empirically within those distributions. Previous preferential attachment models have generated specific distributions with turnover using arbitrary add-on rules, but turnover is an inherent feature of our model. The model also replicates an intriguing new relationship, observed across a range of empirical studies, between the power law exponent and the proportion of data represented.

Full paper

The Evolution of Institutions for Commons Management: An agent-based model

Giangiacomo Bravo

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Abstract. The joint exploitation of an open-access natural resource represents a social dilemma with no escape for rational actors. Nevertheless, real individuals are not harmlessly trapped in the dilemma and are often able to sustainably manage their commons thanks to the creation of endogenous institutions. The agent-based model presented here simulates the management of a common-pool resource by focusing on the relationship between agent beliefs and institutions. All the conditions where agents are allowed to build a management institution lead to much better outcomes than the baseline model, where agents can only rely on their individual beliefs in order to limit their harvesting. This happens despite the fact that agents act in a competitive environment, negatively selecting agents achieving low earnings. Overall, a much higher sustainability level is reached thanks to the establishment of the institution: a dynamic that resembles to the ones observed in empirical settings.

Full paper

Simulating “Stage” Theories: An exploration with applications

Edmund Chattoe-Brown

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Abstract. This paper presents a simulation of so-called stage theories, systems in which states of agents are obliged to follow fixed sequences. Put more simply, an agent can only reach stage x from stage $x-1$. A general example is provided by education (where, for example, it is necessary to understand arithmetic before understanding algebra) but the stage idea is often found in specific social theories, for example, that of Becker (marijuana use) or Rambo (religious conversion). While stage theories are relatively common in social science, they seem to have received little formal attention as a general class and the purpose of this paper is to clarify their structure and understand their properties better using exploratory simulation with a view to further empirical research.

Full paper

MASON RebeLand: An agent-based model of politics, environment, and insurgency

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Abstract. Social simulation models from computational social science are beginning to provide significant advances in terms of implementing more complex social, human, and natural dynamics that are characteristic of how real-world countries operate. The MASON RebeLand model presents three innovations: (1) an explicit polity model with politically complete structure and processes; (2) social and natural model components within an integrated socio-natural system; and (3) generative dynamics where insurgency and the state of the polity (stable, unstable, failing, failed, recovering) occur as emergent phenomena under a range of social and environmental conditions. Earlier agent-based models (ABMs) on similar topics have been useful in covering parts of RebeLand's scope. Three scenarios are demonstrated, showing stable, unstable, and failing polity conditions. The MASON instrumentation also permits additional experiments and extensions.

Full paper

Why Does Individual Risk Perception Matter in Land Use Modeling? Combining survey data and agent-based land market model

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Abstract. This paper aims to understand the effects of biases in individual flood risk perception on aggregated land use patterns and their implications for macro policy. We develop a spatially explicit land market model and parameterize individual risk perceptions with data from a survey held in the Netherlands in 2008. Two sets of experiments are presented. A model with heterogeneous agents produces qualitatively different results compared to a model with homogeneous agents. Individuals with low flood risk perception drive urban developments into the economically inefficient zone and leading to the increasing potential damage.

Full paper

Homophily and Competition: A model of group affiliation

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Abstract. How can we understand the interaction between the social network topology of a population and the patterns of group affiliation in that population? Each aspect influences the other: social networks provide the conduits via which groups recruit new members, and groups provide the context in which new social ties are formed. While many social simulation models exhibit group formation as a part of their behaviour (e.g., opinion clusters or converged cultures), models that explicitly focus on group affiliation are rare. We introduce one such model, based upon the ecological theory of group affiliation, and use it to explore the effect of two system properties - bias toward the creation of homophilous ties and competition between groups - on the dynamics of social evolution and group formation.

Full paper

An Agent-Based Simulation of the French Labour Market: Studying age discrimination

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Abstract. We present here an agent-based model and simulation of the French labour market, WorkSim. Based on an existing economic model, ARTEMIS, WorkSim is a full multiagent system, where agents (e.g. individuals, rms) possess detailed attributes and elaborate behaviour in order to reect the real labour market as close as possible. We illustrate our approach with two main simulation results : the reproduction of one peculiar stylized fact, i.e. discrimination against the youth, and the impact of a new labour contract introduction

Full paper

Effect of Online Word-of-mouth Communication on Buying Behavior in Agent-based Simulation

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Abstract. This paper discusses online word-of-mouth communication and uses an agent-based model to investigate the importance of knowledge-based communication for effective diffusion of information. By constructing the model, we focus on three axes: consumer component, number of interaction partners, and consumers partner selection rules. Consumers are categorized as Early Adopter, Individualist, Trend Maker, or Follower along “information retrieving” and “information outgoing” axes. According to the simulation of our agent-based model with several scenarios, a cascade of buyers plots a S-shaped curve and that the early adopters buy the good first and the trend makers generate word-of-mouth communication and then it comes over the followers. Besides, if people choose partners on the basis of their personal knowledge levels, both efficient and inefficient diffusion of information emerges. Inefficient diffusion occurs in the case that they choose persons with their similar level of knowledge, while more efficient diffusion occurs in the case that with higher level. This insight may indicate the existence of alpha bloggers or signal the emergence of a new regime in Internet-based communication.

Full paper

Size Matters: Results from large-scale replications of experiments with FEARLUS

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Abstract. We report on replications of early experiments with FEARLUS, using larger numbers of agents than in the original work. We find that results from the larger-scale experiments differ from the smaller environments used previously. Whilst it may be argued that results from smaller communities of agents should not be ignored just because the same effect is not observed in larger communities (and indeed vice versa), this work does raise the extent to which more general conclusions can be drawn from agent-based studies involving fixed population sizes.

Full paper

Replication of the Demographic Prisoner's Dilemma

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Abstract. This paper documents our efforts in replicating Epstein's (1998) demographic prisoner's dilemma model. While, qualitatively speaking, our replicated model resembles the results of the original model reasonably well, statistical testing reveals that in quantitative terms our endeavor was only partially successful. This fact hints towards some unstated assumptions regarding the original model. Confronted with a number of ambiguous descriptions of model features we introduce a method for systematically generating a large number of model replications and testing for their equivalence to the original model. With the help of this approach we show that the original model was probably based on a number of dubious assumptions. Finally we conduct a number of statistical tests with respect to the influence of certain design choices like the method of updating, the timing of events and the randomization of the activation order. The results of these tests highlight the importance of an explicit documentation of design choices and especially of the timing of events.

Full paper

Conditionally Risky Behavior vs Expected Value Maximization in Evolutionary Games

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Abstract. Inspired by much empirical evidence of human decision-making under risk that does not coincide with expected value maximization, much effort has been invested into the development of descriptive theories of human decision-making involving risk (e.g. Prospect Theory, Regret Theory, SP/A Theory). An open question is how behavior corresponding to these descriptive models could have been learned or arisen evolutionarily, as the described behavior differs from expected value maximization. We believe that the answer to this question lies, at least in part, in the interplay between risk-taking and sequentiality of choice in evolutionary environments. We provide simulation results for evolutionary game environments where sequential decisions are made between risky and safe choices. Our results show there are evolutionary games in which agents that are sometimes risk-prone and sometimes risk-averse can outperform agents that make decisions solely based on the maximization of the local expected values of the outcomes.

Full paper

Simulating European Union R&D policy - Knowledge dynamics in EU-funded innovation networks

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Abstract. This paper discusses an agent-based simulation describing the science landscape in the European Union. The model focuses on the network structures resulting from the research cooperations of the actors participating in the European Framework Programms (FP). The paper presents the empirical data based on which the model is developed, and shows the internal structure of the simulation, including the simulation cycle of the agents and their operational background. Furthermore it discusses the results of the model by means of a standardised scenario, which is compared to the real FPs networks, and a policy driven experiment, which shows the potential of the model.

Full paper

Agent-based Policy Assessment in Indonesia: Poverty, energy and forests

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Abstract. Adaptation dynamics of communities to environmental change, such as rainfall, forest stocks, fish stocks and flooding, have a multitude of consequences for livelihood choices, poverty and natural resource use. Emerging properties of related household level behavior are analyzed in the context of energy related policy changes in an agent-based model implemented in East Kalimantan, Indonesia. The underlying hypothesis is that complex systems modeling can help decision makers to better understand the responses of a socio-ecological system to macro-policy changes, for example fuel subsidy reductions. Two modeling processes are presented in this paper. The participatory model development process revealed that many decision makers implied linear responses of poverty indicators to policy interventions. The agent-based model offered the opportunity to consider feedbacks created by interactions in the socio-ecological system. Model results indicate that poverty responses to changes in fuel subsidies and poverty cash payments are highly non-linear. Post-modeling stakeholder discussions highlighted the impact of the participatory process on improved policy understanding.

Full paper

The Effectiveness of Reminders: Testing the adequacy of a prospective-memory model based on dynamic field data

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Abstract. The paper presents a system analysis of an evidence-based formal model that was developed for investigating the effects of reminders during behavior-change campaigns. The model replicates well time-series data that were gathered during a recycling campaign in Cuba; it accurately forecasts the recycling behavior for several weeks based on a calibration with data of the first week only. The generalization ability of the model was proved by cross validation. The model is parsimonious since further simplifications lead to a worse fit and systematic errors. The model is identified (i.e. the parameter values can be precisely estimated). The estimation uncertainties of parameters that control very slow processes, however, have a strong influence on the output and result in forecasting uncertainties. We identify these parameters by global sensitivity analysis and quantify the output uncertainties by a Monte Carlo uncertainty analysis. The simulation shows a strong positive effect of reminders on the recycling behavior.

Full paper

An Attempt to Integrate Path-dependency in a Learning Model

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Abstract. The absence of information on the state of the resource is considered as one of the main reasons of resource collapses. In the current study, we propose a solution to this problem stemming from the resource users. They can perceive the resource dynamics by the impact it has on their profits. At a given time step, the state of the resource depends on its previous states and hence on the agents past decisions. In this perspective, different perceptions are characterized by different weights that the resource users assign to the current and past actions in the profit formation. In order to capture these individual differences, we consider Schaefer-Gordon dynamic model. On its basis, we develop a learning model, adapted from Roth-Erev model. The simulation results show that the resource can be exploited in a sustainable manner if the past action is taken into account.

Full paper

A Grid-Oriented Social Simulation Framework for Large Scale Agent-Based Modeling

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Abstract. Intrinsically, large-scale social simulation models with a vast parameter space as well as multi trials require highly intensive computational resources. This paper proposes a grid-oriented social simulation (GOSS) framework for the purpose on a grid computing environment. We focus on two social simulation methods: i) forward-simulation to conduct sensitive analysis of micro-level agent parameters and ii) inverse-simulation to search for optimal macro-level phenomena to give the optimal simulation results with various micro-level parameter set using Genetic Algorithms (GAs). We develop GOSS framework to obtain better simulation results with a short CPU time. The framework is designed to be easily used from one laptop terminal and linearly scalable on a grid computing environment with the number of simulation trials. In this study, we apply GOSS to the two examples: organizational behavior analysis and history simulation. We have also validated the efficiency of GOSS by the scalability evaluation.

Parallel Papers

Traffic and Safety

Full paper

Moscow Traffic Jam Is Under Attack of an Intelligent Agent-based Model

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Abstract. The paper deals with conceptual description of an agent-based model for Moscow city transportation system. The model was created in the framework of the project dealing with strategy of city development till the year 2025. The study aims at presenting a solution to transportation problem in Moscow, which is one of the serious issues in all megapolises. As is shown below, development of calculation packages and specialized software, used for practical realization of agent-based model, allows computing a solution to the problem.

Full paper

A Study on Human Communication and Human-smoke Interaction under Fire Evacuation

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Abstract. Underground shopping mall has some constructional problems and peoples behavior problems on fire evacuation. That is, there are similar sights, many narrow exits and some wide exits. Pedestrians tend not to notice narrow exits while they evacuate from the underground shopping mall. On the other hand, the wide exits, which can be found easily, will be crowded. If the emergencies such as fire accident were happened, pedestrians would have to go out soon. Under such circumstances, the underground shopping mall has high risk for pedestrians life. If fire was caused, pedestrians will lose the direction of exit by the smoke. In this research, we will try to build model of human-smoke interaction and model of human communication. We suggest human communication is possible to help earlier evacuation effectively.

Full paper

Communication of CO₂ Capture and Storage (CCS): Simulating the impact on knowledge and public acceptance

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Abstract. CO₂ capture and storage (CCS) is a set of technologies that enables the reduction of CO₂ emissions from coal-based electricity generation. One important precondition for its large-scale deployment is its public acceptance. However, in the present situation, the level of awareness, knowledge and attitude formation with regard to CCS vary within society: whereas stakeholders have a high level of awareness and knowledge of CCS, both awareness and knowledge among the general public are very low or virtually nonexistent. Thus, information on CCS is currently transmitted in the form of one-way communication, whereby the knowledge and attitudes of lay persons concerning the technologies are influenced by messages from stakeholders containing different evaluations of CCS. This paper describes the elements and discusses the results of a multi-agent model, which was used to explore this specific form of CCS communication.

Social Norms

Full paper

Dissecting the BOID Perspective on Norms

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Abstract. In this talk the BOID architecture of normative agents is evaluated against research directed at the target systems. In the human sciences, internalisation is a crucial element within the concept of norms, to distinguishes normative behaviour regulation from mere coercion. The aim of this article is to begin answering the question of to what extend the BOID architecture represents the theoretical construct of norm internalisation as it can be discerned from sociali-sation research in psychology and sociology. Evaluation of the findings from the empirical sciences allows drawbacks and opportunities in existing architec-tures to be identified, as well as suggestions for future development.

Full paper

Where and when we hunt counts more than how much we hunt: A case study on Bay Duikers in North East Gabon using a multi agent system

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Abstract. Many studies have documented that bushmeat is the main source of protein and the most important source of income for rural people in the Congo Basin, but overexploitation of bushmeat species is also a major concern for conservationists. In the last two decades, a growing number of studies have tried to determine the Maximum Sustainable Harvest (MSH) based on the density and productivity of hunted populations. However, one component that is not addressed by these simple models, but is increasingly recognized as being crucial for the sustainability of hunting, is the existence of source-sink dynamics at the landscape level from un-hunted areas (protected areas) to hunted areas (close to villages or roads). However the implications of spatial heterogeneity at the scale of the village hunting territory have not yet been explored. In this study, we use a multi agent model to capture the dynamics of the hunter-prey-landscape system, using a case study of hunting of the bay duiker (*Cephalophus dorsalis*) in the village of Ntsiet in North-East Gabon. We modelled two types of agents at the individual level, the duiker and the hunter. The population dynamic of the duikers emerges from territorial interactions among duiker agents (dispersal, establishment of individual territories, reproduction, movement within an individual territory). The spatial and temporal distribution of hunting effort over the village hunting area emerges from individual hunting choices that differ according to the season. We show that the impact of hunting on prey populations is dependent on the existence of source-sink dynamics at small scales within a hunting area, caused by the spatial distribution of both hunters and prey. Within a village territory, the existence of areas hunted all year round, areas hunted only at certain seasons and un-hunted areas, contributes to the sustainability of the system. Prey population levels and offtakes per hunter are particularly sensitive to the rhythm of hunting (frequency and length of hunting sessions) as well to the number of hunters sharing the same area. Detailed knowledge both about species biology and behavior and about hunting practices are crucial to understanding the distribution of sinks and sources in space and time. Given the recognized failure of simple biological models to assess maximum sustainable yields, multi agent models provide an innovative path towards new approaches for the assessment of hunting sustainability, provided further research is encouraged to increase our knowledge of prey species and hunter behavior.

Full paper

‘What did you say?’ Emergent Communication in a Multi-Agent Spatial Configuration

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Abstract. This paper reports the results of a multi-agent simulation designed to study the emergence and evolution of symbolic communication. The novelty of this model is that it considers some interactional and spatial constraints to this process that have been disregarded by previous research. The model is used to give an account of the implications of differences in the agents’ behaviour, which are embodied in a spatial environment. Two communicational dimensions are identified and four types of communication strategies are simultaneously tested. We use the model to point out some interesting emergent communicational properties when the agents’ behaviour is altered by considering those two dimensions.

Full paper

How Do Agents Learn to Behave Normatively? Machine learning concepts for norm learning in the EMIL project

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Abstract. This paper is a contribution to the FP6 project Emergence in the Loop (EMIL). The objective of this paper is to give an overview of machine learning concepts for normative learning which can be implemented in the EMIL simulation suite. The motivation of normative agents to behave in a socially conforming manner on the one hand and according to their internal attitudes concerning the society on the other, made new concepts of learning necessary beyond pure reinforcement techniques. We distinguish between influences of authorities, peers and subordinates, besides we give agents an internal penitence level as precondition for the willingness to change their behaviors. A genetic algorithm implements a process of norm innovation as it generates rules not foreseen by the modeler. In the next step the presented concepts will be implemented in the simulator EMIL-S. The implementation will be completed in September.

Full paper

On Norm Internalization: A position paper

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Abstract. Internalization is at study in social-behavioural sciences and moral philosophy since long; of late, the debate was revamped within the rationality approach to the study of cooperation and compliance since internalization is a less costly and more reliable enforcement system than social control. But how does it work? So far, poor attention was paid to mental underpinnings of internalization. This paper advocates a rich cognitive model of different types, degrees and factors of internalization. In future work, it will be implemented on a normative agent platform to simulate the individual and social effect of internalization.

Full paper

Modelling Hume's Moral and Political Theory

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Abstract. Hume's moral and political theory is about fundamental processes in the evolution of societal life. HUME1:0 is a computer model that tries to reconstruct this theory. Humes theory is rich and informal. The formal reconstruction allows to study in detail the complex dynamical interplay of a bunch of mechanisms in Humes theory. We should be able to analyse systematically under explicitly specified assumptions in which regions of the parameter space virtues, specialisation, and wealth prosper; and how robust or how sensitive these processes are when parameters and/or mechanisms vary to some degree. The paper describes the components of HUME1:0, solutions of design problems, some first results, and further research perspectives.

Full paper

Moscow Kiosks: Sellers discovering about markets

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Abstract. Our work is part of a quite general research in contemporary economics which focuses on the understanding the emergence of behavioural patterns on markets. In particular, we wish to produce and analyse data produced by hypotheses about the behaviours of sellers in a decentralized economy facing local demand curves. The model we build here is based on the idea that sellers react to each other and adapt their behaviour accordingly. Hypotheses are based on data gathered on an actual market, the kiosk market in Moscow in the 90s, from which several stylised facts have been extracted. In particular the way sellers get influenced by other sellers when they have to choose the price for the good they sell has been documented. The model shows that the asked quantity can have a great influence on heterogeneity of prices between different local markets. For the moment, our simulation model has not given many results that cannot be attained analytically, but we give some hints about our way forward.

Policy Modelling

Full paper

Building an Agent-Based Model for Exploring How Informal Rules May Impact the Functioning of Newly-established Water User Associations in Central Asia

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Abstract. In transition countries informal institutions play a major role and often interfere with new formal institutions leading to large discrepancies between rules on paper and rules in use. We develop an agent-based model to explore the interaction between formal and informal rules and its effect on the performance of the formal institutions, based on the example of water user associations (WUA) in Uzbekistan. The model is based on field experience such as community-based work and role playing games, complemented by available literature. In this paper we present the conceptualization of the model, its empirical foundation and a first baseline scenario. We model a water user association where rules based on formal and informal institutions can be used. The baseline scenario represents the results of a totally formal WUA. In a next step we will introduce informal rules and explore how they can coexist with formal ones. Further work will bring us to question rules implementation and roles and relationships evolution through selective rules adoption. The model will allow exploring under which conditions the institution WUA can function well and what might be mechanisms for the selection and adoption of rules by individual members.

Full paper

Simulating Patterns of Heroin Addiction within the Social Context of a Local Heroin Market

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Abstract. This paper uses agent-based modeling (ABM) to identify patterns in heroin addiction shaped by the market in which the drug is sold. Research has characterized the biological motivations and social behaviors of people addicted to heroin. Animal research outlines mechanisms associated with an addiction to opiates. Behavioral studies described how heroin users experience addiction, as well as its various outcomes. Finally, scientists have researched how heroin is acquired and distributed through various local drug markets. Using ABM, this paper unifies these disconnected domains simulating how heroin addiction patterns are generated through heroin markets. Extracting data from an ethnographic study of how a local heroin market operated, a market model was developed. Several different types of agents sell the drug in this model. Customer agents use heroin and when they run out of drug they must purchase more through the market. Data evaluate customer agent addiction levels during the 12-month simulation of the market. Preliminary analysis reveals binge / crash, stepped and stable patterns in customer addiction levels.

Full paper

A Regional, Spatially Explicit Agent-Based Model of Individual Acceptance of Climate Change Adaptation Measures

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Abstract. Climate change and its consequences are to attract much attention on many levels. Understanding the processes of individual adaptation as well as public reaction to and evaluation of policy defined adaptation strategies in this matter is a challenging field of research. We address this issue by developing a spatially explicit multi-agent simulation model for the Northern Hesse region located in the centre of Germany. Agents represent households that are grouped according to their social differentiation by lifestyles. In addition to geographically differentiated, demographical-economic data, simulations are based on empirically gained data on individuals perceptions of both local opportunities and restrictions that are derived from several scenarios of climate change.

Full paper

Usefulness of Simulating Social Phenomena: Evidence

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Abstract. This paper discusses partial results of an ongoing project analysing current usefulness and implications of developing research on social simulation models beyond academic, hobbyist or educational purposes. Design, development and testing phases are discussed along with issues evidence-driven modellers often face whilst collecting, analysing and translating quantitative and qualitative data into social simulations. Methodological recommendations are presented in light of evidence gathered in published literature and interviews with researchers that have lead long-term (3 to 5 years) projects in this field.

Full paper

Participatory Validation of Agent-Based Models to Support Policy Dialogue

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Abstract. Agent-based modelling (ABM) can be used to integrate knowledge from different domains, explore the consequences of different decisions in a formal, analytical system, and as a basis for engaging a variety of stakeholders when collecting necessary data, checking the validity of the model and interpreting the results. Participatory validation provides an opportunity to present back various pieces of information, contained in and generated by the model, as part of a structured dialogue and thereby develop a shared understanding of the domain, identify areas of contention, and build on existing social networks between actors with a stake in the policy process. The modelling exercise thereby moves beyond the boundaries of science into the policy domain, making scientific and indigenous knowledge more accessible to actors involved in policy making. This paper attempts to demonstrate this policy-oriented approach by presenting agent-based models that were developed to analyse the role of social networks in supporting community-based strategies for dealing with environmental, health-related and economic stressors in the case of Sekhukhune, South Africa.

Full paper

Nice and Nasty Lawyers, is the Legal System to Blame? Agent-based simulation insights

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Abstract. All substantive areas of law with no exception have a common concern for the processes by which legal disputes get resolved. Naturally, the success of any particular litigation strategy in a legal dispute depends on a number of factors. Examples of influential factors are procedural costs, the judges accuracy and, most importantly, the litigation strategy followed by the counterpart in dispute. Previous work has focused on analysing legal disputes individually, thus providing an answer to the question: What litigation strategy may be most appropriate when confronted with a particular counterparts strategy? The problem, of course, is that the counterparts strategy is rarely known in advance.

In contrast, in this paper we adopt a dynamic view of the legal system as a whole. To do this, we assume that the most successful litigation strategies at a certain time are more likely to be followed in the future, so the prevalence of different strategies in the system will generally change in time. Importantly, this change in the frequency of litigation strategies in the legal system will in turn affect the relative success of each litigation strategy, thus creating a double feedback loop between prevalence and success of litigation strategies, which we aim to explore in this paper.

Thus, the main purpose of this paper is to offer a novel approach to study legal disputes, looking at the whole litigation system as a single entity that evolves through time. In particular, we focus on cases of medical liability, and use agent-based simulation to provide a dynamic view of how various factors, such as the magnitude of legal expenses and the accuracy of the judicial system, affect the type of litigation strategies that are successful and prevail in a certain judicial context.

Full paper

An Agent-based Model of Business Cycle

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Abstract. We attempt to construct a simple agent-based model of real and financial sectors that can reproduce business cycles. In contrast with neoclassical model of a single good, the firms take into account the relative price between capital and consumer goods as well as the demand constraint in deciding how much to invest, and how many workers to employ. Moreover, the bank endogenously provides money supply. Our artificial macro-economy appears to reproduce business cycles with some properties that are consistent with salient facts: The money supply and the amount of new orders for capital goods are good leading indicators, and the real wage rate is weakly correlated with business cycles. Our artificial experiment on banking regulations suggests the efficacy of the proposed dynamic provisioning in stabilizing the economy.

Social Conflict

Full paper

The Importance of Disagreeing: Contrarians and Extremism in the CODA model

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Abstract. In this paper, we study the effects of introducing contrarians in a model of Opinion Dynamics where the agents have internal continuous opinions, but exchange information only about a binary choice that is a function of their continuous opinion, the CODA model. We observe that the hung election scenario still exists here, but it is weaker and it shouldn't be expected in every election. Finally, we also show that the introduction of contrarians make the tendency towards extremism of the original model weaker, indicating that the existence of agents that prefer to disagree might be an important aspect and help society to diminish extremist opinions.

Full paper

Microsimulation of Virtual Encounters: A new methodology for the analysis of socio-cultural cleavages

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Abstract. Contrary to the USA, Europe is a rather heterogeneous area, not only with regard to its regional economics, but also in view of its cultural variation. By the rapid growth of the number of countries belonging to the European Union, the resulting socio-cultural cleavages will probably become more visible and politically more important, mainly due to the expected increase in labor migration across the former national borders.

Full paper

Social Network Evolution Based on Agent Centrality

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Abstract. We consider a general stochastic model of social network formation and evolution. In this model, agents form and sever links basing their decisions on the centrality of their potential partners. We consider different types of centrality measures and show that they can be unified in our model. We show how the emergence of hierarchies depends on the volatility of the environment and that there exists a sharp transition from strongly centralized to decentralized networks. Finally, we solve the time evolution of the model and show that the stationary networks exhibit topological properties that qualitatively match with features of social and economic networks.

Full paper

On Culturally Contextualized Models of Conflict: An evidence-driven perspective

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Abstract. In many fields of the social sciences, models couched in cultural contexts are nothing new. In conflict research they are. Agent-based modeling, furthermore, is a technique that affords problem-driven model design. That is models are informed by empirical evidence instead of being based on assumptions. A critical review of existing work on cultural modeling is presented followed by a selection of extensions for this research. Based on this we theorize against some concrete examples on: Whether more realistic socio-cultural cognitive and behavioral implementations lead to more expressive simulations?; What the usefulness of endogenous explanations is?; What the prospects of forecasting on cultural patterns are?

Full paper

A Meta-Analysis of Social Conflict: The social simulation comprehensive approach

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Abstract. We discuss the field of formal, in particular computational methods to study social conflict, in order to approximate the Weberian notion of “*verstehen*”. While traditional theoretical distinctions, such as structuralist and interactionist approaches, can be revealed in classical formal methods, agent-based modeling can at best be couched in terms of complexity and emergence. This methodological impulse might be able to shed light on the nature of conflict generating mechanisms. However, so far this promise remains under-explored.

Full paper

Ecology in Agent-Based Modeling of Conflict

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Abstract. In this paper we propose a new methodology for agent based modeling of conflict, that we show it brings a better understanding - and thus a better simulation - of conflicts and their origins. We argue that the underlying methodology for the agent based models of conflict should be one of dynamic ecology and the underlying theory for understanding the mechanisms should be the canonical theory. Under this framework, we distinguish between the fast and slow processes in the model of conflict and we apply this two-dimensional framework to radicalization.

General

Full paper

MASUS: A multi-agent simulator for urban segregation

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Abstract. Urban segregation represents a significant barrier to achieving social inclusion in cities. In order to mitigate this problem, it is necessary to implement policies founded upon a better understanding of segregation dynamics. This paper proposes MASUS, a multi-agent simulator for urban segregation, which provides a virtual laboratory for exploring the impact different contextual mechanisms have on the emergence of segregation patterns. We illustrate the potential of MASUS through two experiments on segregation in So Jos dos Campos, a medium-sized city in south-east Brazil. The first experiment validates the model through its indication that the simulated data is a good representation of segregation in So Jos dos Campos. The second experiment explores the relationship between segregation and income inequality and demonstrates that decreasing levels of income inequality promote spatial integration of different social groups.

Full paper

Energisers, Boundary Spanners and the Knowing-Doing Gap

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Abstract. Models of the diffusion of innovations are not uncommon, but few of them provide much insight into why innovations are often not taken up by those aware of them. Why do superior ideas, technologies and practices fail to motivate people to adopt them? This paper builds upon theories of emotional energy and group solidarity in explaining the role played by the cultural boundaries between two distinct communities of practice. Our simulation model represents an extension of the classic Axelrod Cultural Model. Illustrating our theoretical points using the simulation model, we examine the scope for a boundary spanner to broker the interactions between the two communities. Three factors are varied: the fitness of the innovation; the rate at which energy decays between interactions and; special energising characteristics of the boundary spanner. All three are found to be interrelated.

Full paper

An Opinion Dynamics Model Using Attitudes on Individuals

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Abstract. We present here a mechanism of opinion dynamics which allows agents to move their opinion away from others'. Our model is based on psychological observations and uses unbounded attitudes. Attitudes not only represent opinions on an external social object but also opinions about the other individuals. The model exhibits dynamics that were not reproducible with models based on bounded confidence. We will expose those situations in a qualitative approach.

Methods, Algorithms and Data

Full paper

Reducing the Modeling Gap: On the use of metamodels in agent-based simulation

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Abstract. Agent-based modeling presents relevant limitations in the management of the process to generate the running simulation from the initial conceptual non-formal models. Considering the different aspects of the creation of a model, which includes abstracting, designing, approximating and coding, it cannot be done in a monolithic way. It is needed to separate those aspects to facilitate their understanding, grasp their relationships, and address their development. Besides, in the case of several roles participating in such process, communication problems may arise between people with different backgrounds and perspectives. This work proposes a modeling middle-layer to solve or reduce these problems. It uses INGENIAS metamodels as a high-level formal methodological language, to define languages in the form of diagrams conceptually close to the domain-expert. This paper discusses how this approach can facilitate the communication, specification, implementation and validation of social simulation models. A case study of an urban dynamics data-driven model illustrates this discussion.

Full paper

New insights on the Emergence of Classes Model

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Abstract. In this paper we show the results of a detailed replication of the Emergence of Classes Model (Axtell et al. 2000). We study the effect of possible biases on the original proposal and we find additional results and conclusions. We also explore the effects of minor changes on the decisions rules that agents play.

Full paper

An Algorithm for the Simulation of Bounded Rational Agents

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Abstract. Non-classical models of economic behaviour, usually summarised under the notion of 'Bounded Rationality' criticise the assumptions of the standard economic model - hyperrationality, perfect and costless information, and unlimited mental processing capabilities. However, alternative approaches have either remained very simple or purely descriptive. In this paper, a computational approach is presented based on Simon's concept of bounded rationality as a compromise between the oversimplification of analytical and the descriptiveness of rich cognitive models.

Full paper

An Experimental Data-Driven Social Simulation Model on Trust

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Abstract. This paper presents an agent-based model built on experimental data collected from a repeated investment game played by 108 human subjects. Firstly, we have replicated the experimental data originally resulted from randomly coupled subjects and then we have modified the interaction structure of the game to study the impact of different interaction rules on the emergence of cooperation. Results show that: (i) cooperation increases when agents are allowed to select their partners; (ii) it is not the stable or unstable nature of the interaction structure that matters per se, but the link of interaction outcome and structure formation.

Rich Cognitive Models

Full paper

A Multi-Agent Simulation Framework for the Study of Intermediation

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Abstract. In trading networks many elements determine the success of the network. They can be economic, social, personal, structural, environmental, etc. In many simulation frameworks only one of these elements is considered. However we argue that it is exactly the interaction between the different types of elements that is interesting when considering the mediation of business processes. Whether a mediator has a right of existence does not just depend on the quality of his service, but also on the social structure between suppliers and users, the communication infrastructure, etc. In this paper we propose an agent based simulation framework in which this type of situations can be studied and we show an example of its use in a simulation of the house market.

Full paper

Sustainability Indicators and Scenarios: Simulating the public's psychological response to climate related risks

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Abstract. For decision makers, like politicians, a decision support system (DSS) can be a convenient way to test and to estimate the impacts of their decisions beforehand. To make such a DSS even more valuable, we propose to also include the citizens response to policies. A multi agent simulation (MAS) can play a methodological key role in a DSS dealing with complex issues and the overall long-term development of the citizens satisfaction. It helps by representing responses of citizen agents to different political-economical scenarios. Since people differ with respect to their psychological reactivity these differences should be modelled including aspects like risk perception and social stratification, e.g. lifestyles. To demonstrate the usefulness of such a concept, we apply it to the perception and the experience of water related risks in the context of climate change. The MAS model and results from scenario runs are shown.

Full paper

A Dialogical Logic-based Simulation Architecture for Social Agents and the Emergence of Extremist Behaviour

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Abstract. In the flourishing research area of agent-based social simulation, the focus is on the emergence of social phenomena from the interactions of individual autonomous agents. There is, however, a relative underexposure of the cognitive properties of agents, as the existing agent architectures often focus on behaviour alone. Cognition becomes particularly salient when the subject under investigation concerns social phenomena where agents need to reason about other agents and those agents' beliefs and their relationships with them.

In this paper we use concepts and methods from dynamic epistemic logic to build agents capable of reasoning about other agents' beliefs in relation to their own belief. We see this as a requirement for any communication with some degree of intelligence. In dynamic epistemic logic, agents are assumed to be perfect rational reasoners. We break with this unrealistic assumption in order to bridge the gap between the sociological and the logical approach. Our model is based on a minimal set of assumptions representing cognitive processes relevant to modelling of the macro-phenomena of group formation and radicalisation.

Full paper

Social Connectedness in Tzintzuntzan: Notes on contextualized reasoning in complex systems

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Abstract. Scholars have proposed the use of a type of a socially contextualized reasoning to implement the cognitive processes underlying the decisions that lead to interactions among agents (action selection). We present a critical review of their research and introduce a number of extensions for their research, which we then test against a real case-study (Tzintzuntzan). Our findings provide support for the yet challenging question whether more realistic cognitive implementations lead to more expressive simulations.

Societal Transitions

Full paper

Testing Social-driven Forces on the Evolution of Niger Sahelian Rural Farming Socio-systems: A combined agent-based modelling and anthropological approach

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Abstract. This article presents the results of a methodology combining an extensive fieldwork, a formalization of field-based individual rules and norms into an agent-based model and the implementation of scenarios analyzing the effects of social and agro-ecological constraints on rural farmers through the study of three different sites in Nigerien Sahel. Two family transition processes are here tested, following field observations and literature-based hypotheses: family organizations can evolve between a patriarchal mode and a non-cooperative one because of family income redistribution tensions. Family inheritance systems can shift between a "customary" mode and a local version of the Muslim one through family land availability tensions.

Our results show that both agro-ecological and socio-economic characteristics determine the simulated family type distribution and consequently the allocation of resources. Results from simulations with no evolution processes show that villages specialize themselves on different economic activities according to natural resources: An intensification gradient is observed from the most favored site, with more local productions and improved ecological indicators, to the less-favored one, with a growing proportion of the population wealth coming from migration remittances and off-shore livestock. Once introducing such processes, the differentiation also occurs within the population level, subdividing it into specializing groups according to their size, their assets and their social status. Emerging individualistic family types increase the village populations' robustness through different and site-specific evolutions.

Full paper

Challenges in Niche Management Strategies for Transitions in Socio-technical Systems

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Abstract. The growing size and complexity of the socio-technical systems, as well as problems encountered with the way these systems function brings about an increasing need for developing a strategy and policy portfolio for managing such systems. One of the strategy proposals from this stream of studies is strategic niche management (SNM). Although the strategy proposed by SNM is intuitive and reasonable in the presence of learning-by-doing type of mechanisms, its application is nothing but straight forward. there exist multiple key points that plays important role in the success of the approach, including the size of the niche where the novelty will be nurtured, the timing for scaling-up, the extent to which the novelty will be protected against competition, and the timing for withdrawing the support provided to the novelty. Due to the enormous variety of situations (e.g. development potential of the novelty and the preexisting option, size of the system, etc.), and also due to the dynamic interactions between the aspects that influence each of those key points, it is almost impossible to provide a well-specified prescription for applying SNM. This study constitutes a preliminary step towards developing such insights. An abstract simulation model that depicts the introduction of a new option in a socio-technological system is developed, used in an extensive exploratory sense in order to analyze dynamic consequences of different implementations of the SNM strategy in terms of final level of diffusion of the novelty in the system, as well as total cost of the strategy.

Full paper

Analyzing Simulations of Energy Transitions: Towards a dynamic path approach

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Abstract. We postulate that the analysis of simulation results should include the statistical confirmation of a causal diagram as a whole. Traditionally, only individual causal relations are assessed at a time or time dependence is ignored. We formulate the criteria for a method that allows for the analysis of simulation data where time dependent data is acknowledged and where multiple relationships exist that can change in strength over time. Because we have not found a method that meets all criteria, we started the development of a dynamic path approach. A promising exploration is presented that leads to an improved analysis of existing simulation results and the related conclusions.

Full paper

Agent-based Simulation of Adoption of Alternative Fuels

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Abstract. We have formalized and parameterized a model for the production of 6 transport fuels and 6 fuels blends from 6 feedstocks through 13 different production chains, and their adoption of by 11 distinct subpopulations of motorists. The motorists are represented by agents that use heuristics to choose a fuel on the basis of three attributes and a social feedback loop.

We find that combinations of interventions are required to bring about a transition away from petrol or diesel, and observed complex behaviour in the model system.

Market Dynamics

Full paper

An Analysis of GreenHouse Gases Trading System: An agent-based approach

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Abstract. The Kyoto Protocol instituted the first legally binding greenhouse gas reduction goals in the world. However, the effectiveness of the protocol is in question in part because of the U.S. signaling withdrawal from the protocol in 2001 and because of developing nations opposed to the cap amounts set by the protocol. This study modeled the greenhouse gas reduction policies as a multi-agent system in which multiple government players, corporation players, and citizen players exist, in order to observe the social dilemma facing corporate players. The importance of suppressing uncooperative corporations (free riders) was also considered to observe the strategic decision making of each player and the number of uncooperative corporations by evolutionary approach. It was also shown that (1) free riders emerging within the greenhouse gas exchange policy are caused, for one, by the unclear extent of accountability for each government, and (2) free riders can be suppressed by the activities of citizens, however, support from the government is necessary for its success.

Full paper

ABMED: A prototype agent-based model of energy demand

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Abstract. ABMED (Agent-Based Model of Energy Demand) is a prototype model of socio-economic and psychological influences on energy demand in a small community. Agents represent households, varying in wealth, income and values, buying and running household appliances and linked by social ties in a network influenced by both spatial proximity and similarity of material possessions (which in turn reflects similarity of wealth, income and values). The early explorations of ABMEDs parameter space reported indicate complex interactions between external circumstances (e.g. availability of credit) and households values in determining energy demand.

Full paper

Volatility in the Consumer Packaged Goods Industry: A simulation based study

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Abstract. The volatility in a CPG market is modelled using a bottom up simulation approach and validated against disaggregated supermarket transactions data. The simulation uses independent agents, each agent representing unique households in the data. A simple behavioural model incorporates household preferences for product attributes, prices and promotions. Our validation strategy tests the model predictions at both macro and micro levels. At the macro level, the model is validated against out of sample evolution of market shares while at the micro level, household level choice of individual products and product attribute combinations are used. The model captures the volatility in terms of market share of brands and flavours – with the direction of change being more accurately predicted than the magnitude. At the micro level, we achieve a reasonable degree of prediction accuracy of household level SKU choice and a substantially higher accuracy for attribute choice. We found that product size to be the most difficult to predict among all attributes.

Full paper

Dynamics of Brand Competition: Effects of unobserved social networks

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Abstract. An oligopolistic market where brands compete against each other is modelled using an agent based approach in order to examine the long run dynamics of market structure and brand characteristics. A repeated game is designed where myopic firms choose a strategies based on beliefs about their rivals and consumers. The strategy set of a firm consists of innovating, copying the competitor and maintaining a status-quo on each characteristic of its brand. Consumers are heterogeneous and can interact with each other. Their preferences are defined on brand characteristics, prices and information about purchases they obtained from their neighbours in a social network, of which firms have limited information. Experiments are carried out for different parameter combinations and network settings. The results show that presence of unobserved social networks have a significant impact on the emerging market structure – markets are more stable in the absence of networks while presence of networks lead to higher volatility. Convergence in brand characteristics is a common feature of the steady states. Brands end up sharing the market equally in absence of networks for all settings, but in their presence, the firm with initial price advantage generally emerges as the market leader. Innovations in the industry are overall more frequent when networks are absent. In the presence of networks, steady states are associated with less frequent innovations than when markets are volatile. The relative cost differential between innovation and copy has no major effect on the emergent characteristics.

Full paper

Dynamic Pricing in Complex Behaving Consumer Markets

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Abstract. This paper is a follow up of the ESSA paper presented by us last year. In this paper we focus on the efficacy of dynamic responses in particular a price-cut - to a decrease in sales. We observe that dynamic pricing strategies, which respond to market shares, increase the survival rates of products. Moreover we show that a faster response to a decrease in sales results in a larger market share and a lower occurrence of price-cuts. The implications of how such simulation tools can be used in practice are being discussed.

Full paper

Growth and Underinvestment: The impact of reactive capital acquisition strategies on market share

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Abstract. Many firms fail to deliver on their potential when they delay capacity acquisition decision for markets that have significant growth potential. The growth trajectory of an exciting new product can be dampened if the ability of an organization to meet market expectations is compromised due to insufficient production capacity. In the management science literature, the market growth model provides a formal basis to study the dynamics of growth, and also can be used to provide insight into why new companies often fail. This short paper presents a simplified version of the market growth model, and describes it from an agent-based perspective. The model is specified using an equation-based approach, and sensitivity runs on important delay parameters show the impact of capital acquisition on the growth potential of a firm.

Social Processes of Science

Full paper

Modelling Scientific Agents for a Better Science

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Abstract. Science is a fundamental human activity and we trust its results because it has several error-correcting mechanisms. Its is subject to experimental tests that are replicated by independent parts. Given the huge amount of information available, scientists have to rely on the reports of others. This makes it possible for social effects to influence the scientific community. Here, an Opinion Dynamics agent model is proposed to describe this situation. The influence of Nature through experiments is described as an external field that acts on the experimental agents. We will see that the retirement of old scientists can be fundamental in the acceptance of a new theory. We will also investigate the interplay between social influence and observations. This will allow us to gain insight in the problem of when social effects can have negligible effects in the conclusions of a scientific community and when we should worry about them.

Full paper

A Model of Social Collaboration in Molecular Biology Knowledge Base

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Abstract. Manual annotation of biological data cannot keep up with data production. Open annotation models using wikis have been proposed to address this problem. In this empirical study we analyse 36 years of knowledge collection by 738 authors in two Molecular Biology wikis (EcoliWiki and WikiPathways) and two knowledge bases (OMIM and Reactome). We first investigate authorship metrics (authoris per entry and edits per author) which are power-law distributed in Wikipedia.

We first investigate authorship metrics (authors per entry and edits per author) which are power-law distributed in Wikipedia and we find they are heavy-tailed in these four systems too. We also find surprising similarities between the open (editing open to everyone) and the closed systems (expert curators only).

Secondly, to discriminate between driving forces in the measured distributions, we simulate the curation process and find that knowledge overlap among authors can drive the number of authors per entry, while the time the users spend on the knowledge base drives the number of contributions per author.

Full paper

Interacting Agent Based Models and Rando Coefficient Auto-Regressive Models

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Abstract. Several Agent Based Models have been proposed based on heterogeneity and bounded rationality to explain stylized facts. However, the complexity of these models does not allow to determinethe dynamic of asset returns. We describe an Agent Based Model where each agent makes decisions by using a sum of two signals. The first is related to fundamental information whilethe second is related to traders' idiosyncratic noise weighted by a term depending onthe last asset returns. This description gives amodelwhere two groups of traderscalled fundamentalists and chartists interact.We show that, if the price impact functionis log-linear, the dynamic of asset returnsbelongs toRandom Coefficient Autoregressive Models RCAM(p). The latter has the ability to generate the main properties of financial time series.

Full paper

The Development of Computational Modeling on the Other Side of the Atlantic: A citation and co-citation analysis of CMOT

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Abstract. With respect to the use of agent-based modeling and other computational methods in the social sciences, two local scientific communities have developed both in the US and in Europe. Although there was always a certain level of exchange between these two communities, it can be quite difficult and time consuming to keep track of the development of the other community. To foster this, the aim of this paper is to map the development of the field in the US by means of a bibliometric analysis of the North American journal Computational and Mathematical Organization Theory (CMOT). First, we use a citation analysis to identify the most influential publications and to provide additional information concerning the specific characteristics of the field. Then, we perform a co-citation analysis to visualize the intellectual structure of the field and its development.

Posters

Full paper

Building a Model on Pillars

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Abstract. In this article a modelling elaboration is presented of a theory on societal transitions. The theory was constructed as a deliberate attempt to be a basis for narrative as well as modelling approaches. The model presented in this article will try put this assertion to the test by implementing the theory as a Java model as directly as possible. This testing will entail producing an actual running model based on the theoretically proposed mechanisms and verifying if the dynamics of this model agrees with what is considered to be typical for societal transitions.

Full paper

The Effects of Brand Equity on Price Strategies: An agent based model

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Abstract. Consumers are highly sensible to different price structures and price promotions. Many studies have showed how customers differently respond when prices are split into separate parts, e.g. a regular price and a shipping and handling surcharge. This phenomenon has recently received much more attention because online sales have continuously and substantially increased in the last years and because online sales imply a price partitioning: product price and shipping price. This gives opportunities to online retailers. They can decide whether to apply promotional tactics on both regular prices and on shipping and handling prices. The price partitioning decision becomes more complicated than usual. Retailers have to choose between a free shipping offer strategy and a price partitioning strategy. In the former case they have to decide a single price that includes the shipping cost and in the latter cases they have to choose upon two prices, a price for the item and a price for the shipping. This paper investigates how firms decide which of these two strategies to adopt and how their brand equities affect their decisions. An agent based model is build that replicates Gm? et al. (2009) results and it departs from it bringing new insights about market partitioning (how many firms adopt which strategy) and the effects of brand equities.

Full paper

LARA: A lightweight architecture for boundedly rational citizen agents

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Abstract. This paper presents a flexible agent architecture called LARA that provides a number of prefabricated, psychologically plausible components like perception, memory, decision screening, deliberate decision making, among others. It aims at modeling a type of agent well suited to answer policy questions. These agents are provided with the capabilities of goal oriented action, habit driven behaviour, risk perception, judgment and acceptance of political measures, and social influence via social networks. The architecture fills a gap between current ABM toolkits and full-fledged cognitive architectures. It is implemented in Java and able to be docked to existing libraries or other agent architectures. The paper presents the various components of LARA and gives an example to illustrate the decision process through the various stages of action selection. Software design criteria and technical issues are discussed.

Full paper

Agent-based Model of Human Behavior: Does similarity affect happiness?

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Abstract. The model of human behavior simulates behavior of individuals in a socio-economic environment. Each individual makes his own decisions based on his personal experience and current emotional state in addition to various traditional economic factors like prices, income, stocks of goods, etc. In section 2 a brief description of the model is given. In section 3 a block of experiments examining correlation between wealth and social homogeneity is discussed.

Full paper

Agent-based Simulation of Structural Balance

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Abstract. This study is a report on results from a early stage in the development of an agent-based model of the development of friendship structures in small groups. It differs from most of the more recent studies in this field in respect to validation. Empirical data from a longitudinal study are used as an initial structure for the model, defining the probability for changes within the friendship structure, and also used as a target for comparison with the results from the simulation. Three models of increasing complexity are proposed, one based on changes in single relations within the group without considering the state of any other relations within the group, one where the dyadic relations are examined in respect to balance, and finally one where all triadic relations are considered. The results indicate that the latter model is the most efficient. Finally, some possibilities for improving the model are discussed.

Full paper

The Role of Social Space in Segregation Processes

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Abstract. There is some empirical evidence that individuals strive for social similarity to the neighbors with whom they live. If this is true, then the question arises: what kind(s) of information do they use and what knowledge do they have, and how do they attain the information necessary to evaluate the social environment of specific locations? The paper discusses two aspects of this multidimensional evaluation process; one of them is the assumption that social space provides part of this information, and, second, it is assumed that knowledge about social-spatial relationships is based on a complex configuration of multiple variables instead of only one central property. These assumptions are translated into a simulation model that adopts empirical data from the city of Salzburg, Austria. Geographic information and simulation techniques are coupled by application of the NetLogo platform and its recently published GIS extension.

Full paper

How Public Goods Can Generate Regional Structure: Simulations on the agent-based model

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Abstract. Regional structure varies substantially across countries. The number of tiers and size of municipalities, counties, lands are quite different. We designed an agent-based model, where it is easy to vary the extent of homogeneity of population and the rules of interactions between agents and evolved jurisdictions. Simulations show big variety of evolved regional structures. It is interesting that most sensitive parameter is a horizon of agents vision.

Full paper

Modeling Practice Diffusion with an Agent-Based Social Simulation Framework

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Abstract. In this paper, we present a multiagent simulation framework for mining and simulating social interactions. From the point of view of social sciences, the theoretical basis of this work is practice theory. The high-dimensional space of practices is analyzed and visualized using the self-organizing map algorithm. Based on the multiagent simulation framework, we present a model of recommending in which the effects of other people and contents of the items to be recommended are included. To evaluate the framework and the recommending, we run simulations using music listening data from the Last.fm service as the source of empirical data. The framework proves to be functional and with additional data for calibrating the simulation parameters and interaction models based on sociological research, the framework is a useful tool for exploring social phenomena.

Full paper

Using a Virtual Machine Environment to Support Simulations on the Grid

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Abstract. Conducting large experiments with agent-based models is becoming common practice. eScience solutions aim to facilitate such scientific activities, including collaboration on a large scale using Grid technologies to enable access to heterogeneous computing resources. However, installing and using simulation environments on such infrastructure is a complex task. In this paper we explore the use of virtualization technologies in combination with existing eScience infrastructure to deploy a re-usable virtual machine image called simulationBox.

Full paper

An Architecture for Agent-based Modelling and Simulation of Geospatial Phenomena

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Abstract. This work presents a general architecture for building and simulating agent-based models that use real-world geospatial data, take into account all the ways geospatial data can feed these models. We focus on how data can be used to create an initial arrangement for the model, as if it was a static representation. We have as hypothesis that the Generalized Proximity Matrix (GPM) is a foundation for setting up the relations between the entities of an agent-based model for simulating geospatial phenomena. The architecture has been implemented in the TerraME framework, which is capable of exchanging data with TerraLib databases. Both softwares are freely available in the Internet.

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